

4.7 Conductivity of Acetic acid, ammonia, and ammonium acetate

Subject: Conductivity, electrolytes

Description: The conductivity of acetic acid and ammonia are measured separately. The solutions are then mixed and the conductivity is measured again. A mixture of the solutions produces a stronger electrolyte solution.

Materials:

Conductivity meter (single bulb apparatus or bulbs in series)*

Vernier Salinity sensor, interface*, and computer (optional)

2 100 mL beakers

1 250 mL beaker

0.1 M acetic acid‡

0.1M aqueous ammonia‡

150 ml beaker for DI water rinse

*Shared item. Located on the shelf with the bins. The salinity sensor and interface are located in the drawers opposite the bin storage shelves. For instructions, see the sensor information web page or the spec sheet included with the sensor. Logger Lite or Logger Pro software is required.

‡Vinegar and ammonia cleaner are located in the solution storage cabinets.

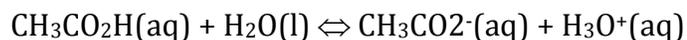
Procedure:

1. Plug in conductivity meter.
2. Pour 50 mL each of acetic acid and ammonia in pre-labeled 100 mL beakers.
3. Place the electrodes of the conductivity meter into each of the solutions (rinsing electrode with DI water in between).
4. The light will glow dimly for each solution since each is a weak electrolyte.
5. Pour the ammonia and acetic acid into the 250 mL beaker.
6. Place the electrodes into the new solution.
7. The light will glow more brightly indicating that the product of the two solutions is a stronger electrolyte than the individual solutions.

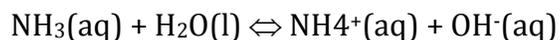
Discussion:

Acetic acid is a weak acid and ammonia is a weak base which means that only a portion of the molecules will dissociate into ions, while some remain as molecules. This makes them weak electrolytes, and they will produce a dim light because of a smaller concentration of ions in solution.

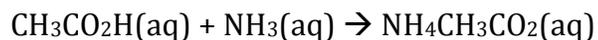
The dissociation of acetic acid in water is as follows:



The dissociation of ammonia in water is as follows:



The reaction of acetic acid with ammonia produces ammonium acetate, which is a strong electrolyte because it dissociates more readily in water increasing the ion concentration:

**Safety:**

Be sure not to touch the electrodes of the conductivity apparatus while plugged in. Ammonia can irritate the skin and its vapors can irritate mucous membranes. Acetic acid can irritate skin and its vapors are irritating to the eyes and respiratory system.

Disposal:

The solution can be flushed down the sink with water.

References:

1. Prof. Botch
2. B.Z. Shakhashiri; *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin; Volume 3; p. 326-328.